Space Weather Technical Forecast

Issued on Tuesday, 07 June 2022 at 01:20 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight Chance of G1 due to CME effects at first, else no significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with X-ray activity measured at GOES16 confined to B-class. There are now just two numbered sunspot regions on the disc, with both stable, unproductive in terms of flares, and magnetically unipolar. Potentially adding to these numbered regions, a third spot group developed in the southwest, reaching Bxo/Beta classification by the period's end, but again, with no flares produced.

A minor coronal dimming was observed in the northeastern quadrant around 06/1300UTC, however any resultant Coronal Mass Ejection (CME) is not apparent on following coronagraph data, and none were observed in the 24 hours.

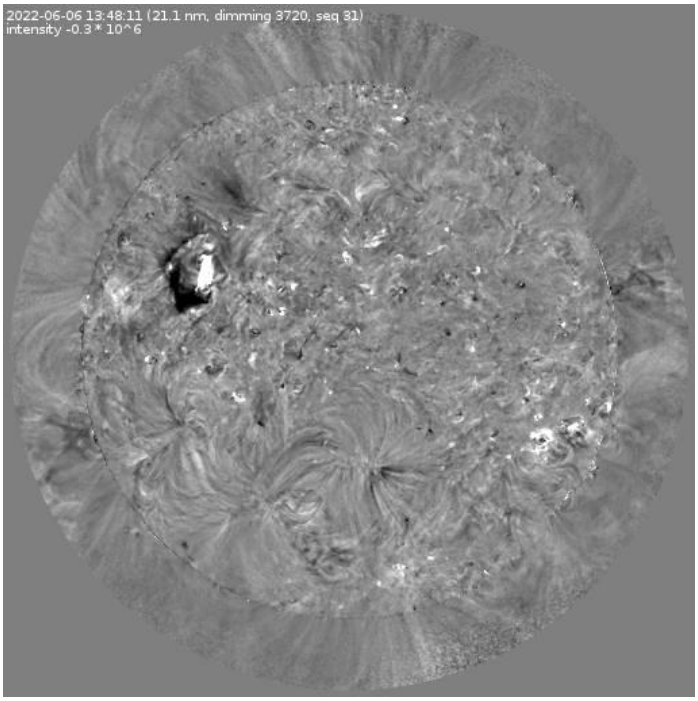

Figure 0: Time-integrated AIA 211 image of the 06/1300UTC northeast quadrant dimming. As yet there is no evidence of any resulting CME on coronagraph imagery. Processing courtesy of SIDC ROB.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR and ACE at L1, started in a slow regime but saw a discontinuity in most measures that coincided with the expected arrival of a CME, possibly that from filament eruption(s) on 01 and 02 June.

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The solar wind speed started the period near 275km/s, but saw a step-wise increase to an eventual peak near 325km/s after 06/0920UTC. The density, which had been hitherto slightly elevated, peaked around 50ppcc before declining as the CME's influence matured, while the IMF peaked at 13nT with a north-south range of +13 and -11nT. The phi angle drifted within a mainly negative sector (towards the sun) but was more skittish for the six hours following the CME's onset, i.e. between around 09 and 15Z.

The net effect of the above solar wind measures was nevertheless mainly Quiet on geomagnetism, with a provisional Unsettled peak Kp of '3o' in the interval containing the arriving CME, 09-12UTC. A small sudden impulse was detected at Earth-based magnetometers following the CME's passing of L1, arriving around an hour later at Earth, and seeing a deflection of around 20nT in the H-component of the B field in 20 minutes at Hartland, UK.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels.

Electron flux was mainly within Normal Background levels in the period. Electron fluence was initially above the Active (1e8 integrated pfu) threshold, but with a sharp declining trend observed, falling from 1.92e8 integrated pfu at 06/0000UTC to 5.69e6 at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low initially. Returning active regions may increase the risk of flares from midweek UTC, although the degree to which this occurs is uncertain pending arrivals over the eastern limb.

Solar Wind / Geomagnetic Activity: Effects from the ongoing 01/02 June CME ought to wane through the first 24-hour period, leaving a slow solar wind regime. There is a Slight Chance of G1 being attained if the slow wind is again interrupted later on day one (Tuesday 07 June and into Wednesday 08 June) by a possible glancing impact from another CME which left the northeast quadrant on 04 June.

Quiet conditions should otherwise again predominate after any CME interjection, ahead of a possible minor coronal hole high speed stream arriving at the very end of the forecast period (from CH87/+), with this perhaps offering Unsettled intervals with a Slight Chance of Active on Friday 10 June.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at Background levels during this period.

High energy electron flux (greater than 2MeV) is expected to vary between Normal Background and perhaps Moderate levels. Electron fluence is expected to remain below the Active threshold throughout, and perhaps for the next week for a lack of forecast potent coronal holes, although confidence in this assertion falls with time.

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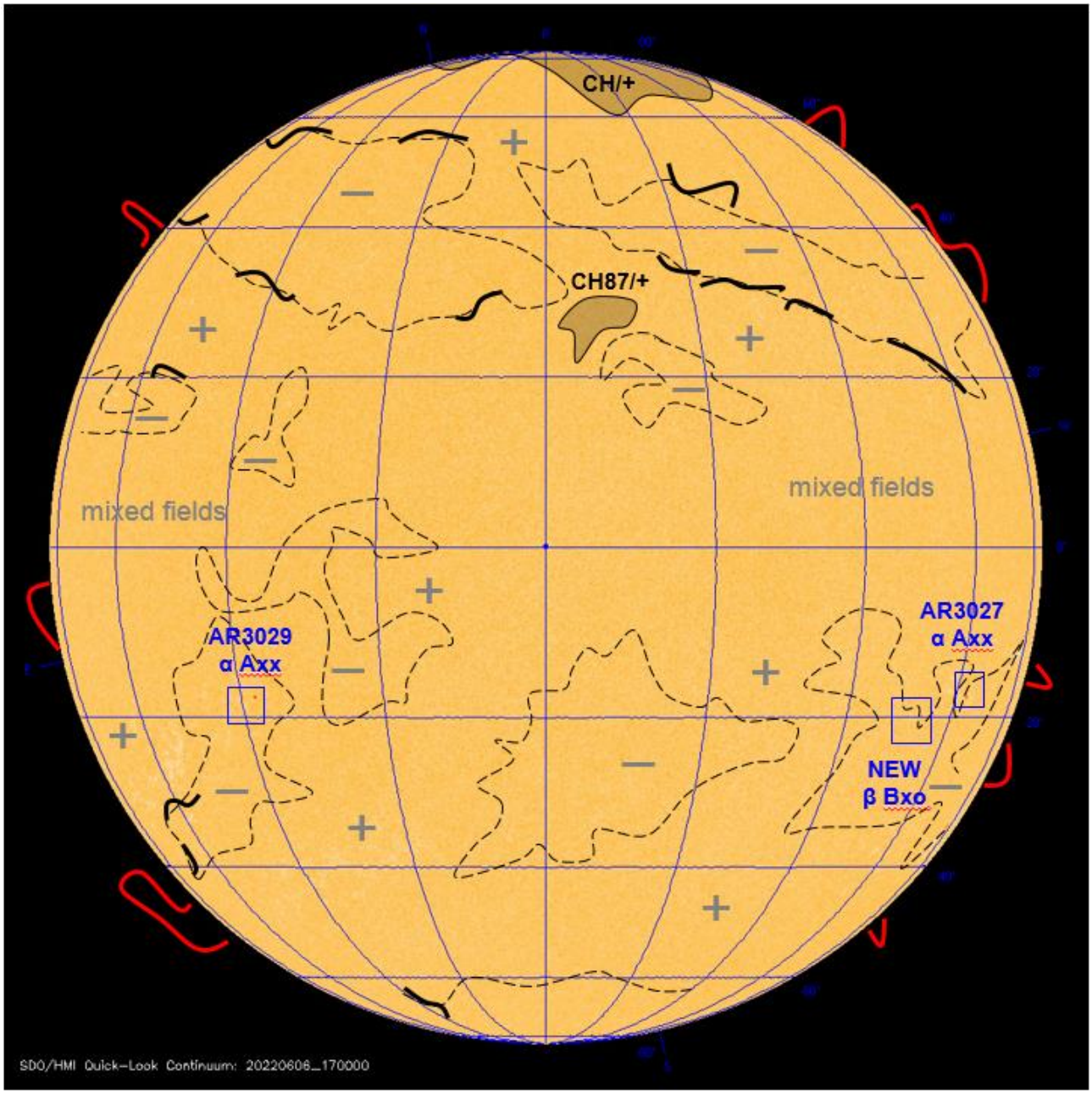
Figure 1. Solar Analysis Valid 06/1700UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Effects from the ongoing 01/02 June CME ought to wane through the first 24-hour period, leaving a slow solar wind regime. There is a Slight Chance of G1 being attained if the slow wind is again interrupted later on day one (Tuesday 07 June and into Wednesday 08 June) by a possible glancing impact from another CME which left the northeast quadrant on 04 June.

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STEREO A MAG and PLASTIC data is not showing any obvious enhancement at present, and the fact its observed phi angle remains negative implies that any influence from CH87/+ is yet to manifest at the satellite, putting it beyond 2.5 days' time in terms of any effect at Earth. Ch87's small stature and Earth's approach to the solstice ought to mitigate against any significant activity in any case, with Active Kp a slight prospect.

The sub-Earth point crossed the solar equator northwards during the UTC day of 06 June and will spend the next six months more directly sampling northern hemisphere solar features.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
04/1032 32 N 30 E	Partial	Filament Eruption	32 N 30 E	620km/s	Most likely missing	Glancing blow possible 07 into 08 June

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Figure 2: L1 solar wind measures showing marked discontinuity at 06/0920UTC, thought to be the arrival of the 01/02 June filament eruption(s) CME(s).

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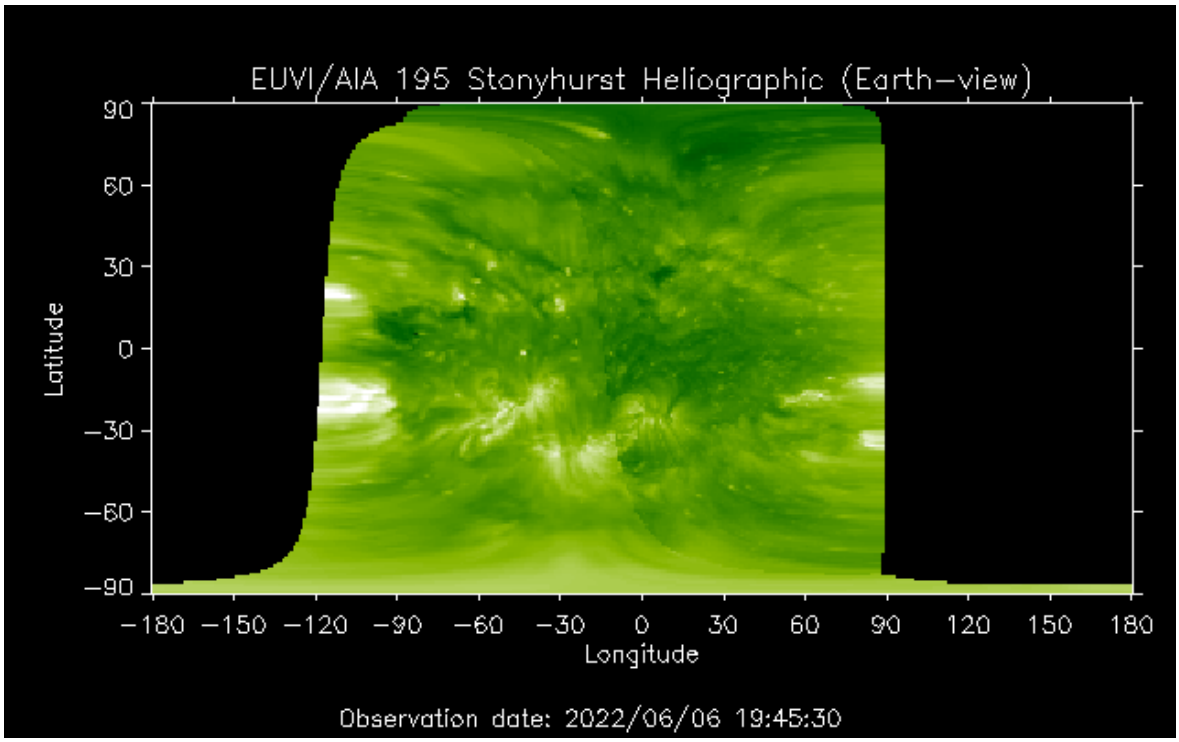
Radio Blackouts - X-Ray Flares:

There are now just two numbered sunspot regions on the Earth-facing side of the sun, with both of these unproductive and unipolar. In addition to these groups, a small bipolar region developed in the southwestern quadrant in the UTC day of Monday 06 June, slightly to the east of the now-departed Ex-AR3023 and 3024.

The current disc offers little in the way of likely sources of activity - barring significant developement - however STEREO A EUVI195 imagery does hint at possible returning region(s), including Ex-3010 and Ex-3011, 3015 and 3014 in turn in the four-day period. This is the rationale for the slight uptick in the risk of M-class flares in the forecast, although this is effectively a placeholder pending any regions crossing the eastern limb for analysis.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: STEREO A EUVI 195 cylindrical projection of upcomign bright flux regions potentially due in the next 2.5 days from over the eastern solar horizon. The region appearing in the southern solar hemisphere near 90 East perhaps corresponds to Ex-3010, while any surviving remnant of the large Ex-3014 may shortly reveal itself in the northern hemisphere.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) saw its oscillation attenuated through the UTC day of Monday 06 June, with its new character mostly within Normal Background. The 24-hour integrated fluence reacted in kind, falling sharply from an early peak above Active to finish the 24 hours comfortably below.

A slight increase in both flux and fluence may begin to show itself once geomagnetic activity from the current CME begins to wane on day one, Tuesday 07 June, however the slow solar wind environment is very unlikely to be capable of supporting much more than Moderate flux, and any further crossing of Active fluence is not likely until the next sizeable coronal hole - something absent from the whole disc at present and therefore perhaps at least a week away.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	10	20	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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